

REMARKS

This is a full and timely response to the final Office Action mailed January 29, 2008, in which Applicants' Claims 1, 3-11, and 13-21 were rejected and Applicants' Claims 3-5 were objected to. By way of this Response, Applicants' Claim 1 has been amended. This amendment is an earnest attempt to advance prosecution and reduce the number of issues and is believed to place this Application in condition for allowance. This amendment was not earlier presented because Applicants earnestly believed that the prior amendment placed the subject application in condition for allowance. Furthermore, entry and consideration of this amendment are believed proper under 37 C.F.R. § 1.116 for at least the following reasons: (1) the amendment does not raise new issues requiring further search or consideration; and (2) the amendment places the Application in better form for appeal, which Applicants intends to pursue, if necessary. Please note that this Response is submitted within two months of the mailing date of the final Office Action mailed January 29, 2008.

I. Claim Objections

On page 2, the Office Action objects to each of Applicants' Claims 3-5 as lacking antecedent basis for a recited step, namely, "the step of chemical mechanical planarizing." The Office Action advises that the "previous language of cancelled claim 2 could be incorporated into claim 1 to give proper antecedent basis."

Applicants wish to thank the Examiner for suggesting a manner in which the objection asserted against Claims 3-5 may be overcome. In keeping with the Examiner's suggestion, Applicants have amended independent Claim 1 to include the language previously recited in Applicants' now-cancelled Claim 2. As amended, Applicants' independent Claim 1 now recites the step of "chemical mechanical planarizing the layer comprising copper and the barrier layer on a single soft polishing pad..." and thus provides antecedent basis for "the step of chemical mechanical planarizing" appearing in each of Applicants' dependent Claims 3-5.

II. Claim Rejections under 35 U.S.C. § 103(a)

On page 2, the Office Action rejects Applicants' Claims 1, 3, 6-11, 13, 14, and 16-21 under 35 U.S.C. § 103(a) as unpatentable over U.S. Pat. No. 7,172,497 B2 ("the Basol reference") taken in view of U.S. Pub. 2003/0040188 ("the Hsu reference"). With respect to Applicants' independent Claims 1, 13, and 17, in particular, the Office Action states that the Basol reference teaches each of the recited steps with the exception of: (1) the use of the claimed soft pad, and (2) wherein the CMP comprises electrochemical mechanical polishing. The Office Action then cites the Hsu reference as teaching each of these missing features. The Office Action concludes as follows:

It would have been obvious to one of ordinary skill in the art to modify Basol et al.'s method of planarization with the use of Hsu et al.'s specific soft pad because Hsu et al. teaches such pads are conventional to have a smooth polishing surface (Hsu et al., paragraph [0064]). Furthermore, it would have been obvious to one of ordinary skill in the art to modify Basol et al.'s step of CMP with Hsu et al.'s step of electrochemical mechanical polishing because Hsu et al. teaches that such ECMP is suitable process for planarizing a substrate and minimizing dishing (Hsu et al., paragraphs [0025], [0028], [0077]).

Assuming *arguendo* that the Office Action has established a *prima facie* case of obviousness under 35 U.S.C. § 103(a) against Applicants' pending claims, such a *prima facie* case of obviousness may be rebutted by showing that the Hsu reference teaches away from Applicants' claimed planarization method in any material respect. See MPEP § 2144.05 citing *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997). By way of this Response, Applicants respectfully submit that the Hsu reference materially teaches away from the planarization method recited in each of Applicants' independent Claims 1, 13, and 17 as explained more fully below.

A. Applicants' Independent Claims 1, 13, and 17 each recite a method of planarization wherein the barrier layer and the copper layer are removed utilizing a single soft polishing pad.

Applicants' independent Claim 1 is directed to a method for planarizing a semiconductor wafer. The method includes, *inter alia*, the steps of: (1) electrodepositing a layer comprising copper having a substantially planar upper surface overlying the barrier

layer and filling at least a majority of each feature cavity, and (2) chemical mechanical planarizing the layer comprising copper and the barrier layer on a single soft polishing pad to remove the layer comprising copper and the barrier layer from the field region and produce a substantially planar surface. Thus, independent Claim 1 explicitly states that the barrier layer and the copper layer (which has a substantially planar upper surface) are polished *on a single soft polishing pad* such that the barrier layer and the copper layer are both removed to produce a substantially planar surface. Applicants' independent Claims 13 and 17 recite similar steps.

B. The Hsu reference describes a multi-step polishing process wherein the barrier layer and copper layer are removed utilizing a number of different polishing pads.

As explained in Hsu Paragraph 0112, the planarization process disclosed in the Hsu reference includes the steps of: (1) "polishing a first conductive material from the substrate surface to a barrier layer," (2) "depositing a second conductive material on the first conductive material by an electrochemical deposition technique," and (3) "polishing the substrate to the dielectric layer." These three steps are repeatedly described throughout the text of the Hsu reference (e.g., through Hsu Paragraphs 0142-0145). These three steps are also illustrated in Hsu FIGs. 8A-8D. In particular, Hsu FIGs. 8A-8D illustrate a first polishing step performed to remove copper layer 830 (FIG. 8A) and expose barrier layer 820 (FIG. 8B), the overfilling of recesses 850 (FIG. 8B) caused by the first polishing step (the results of the overfilling step are shown in FIG. 8C), and a second polishing step to partially remove the overfill material and yield a substantially planar surface 880 (FIG. 8D).

In multiple passages, the Hsu reference explicitly states that the different polishing steps utilized to remove the barrier layer and copper layer are performed utilizing different polishing stations and, therefore, utilizing different polishing pads. For example, Hsu Paragraph 0113 states that a first polishing step is performed at a first polishing station (steps 700 and 710); various subsequent deposition steps are performed at other processing stations (steps 720 and 730); and, finally, a second polishing step is performed at a second polishing station (step 740). Similarly, Hsu Paragraphs 0142-0145 describe a planarization

process wherein the substrate is polished at a first station (and thus with a first polishing pad), transferred to deposition station, and then polished at a second polishing station (and thus with a second polishing pad).

C. The Hsu reference consequently teaches away from the method recited in Applicants' independent Claims 1, 13, and 17.

MPEP § 2141.03 states that “[p]rior art reference must be considered in their entirety, including any disclosures that teach away from the claimed method or structure.” As explained above, the Hsu reference teaches, in various passages throughout its body, a multi-step polishing process wherein the barrier layer and copper layer are removed utilizing a number of different polishing pads. The Hsu reference, then, teaches away from a planarization process that utilizes a single soft polishing pad to remove both the barrier layer and the copper layer in the manner described in Applicants' Detailed Description and recited in Applicants' independent Claims 1, 13, and 17.

MPEP § 2144.05 states that a *prima facie* case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997). Applicants have shown that Hsu reference materially teaches away from the planarization method recited in Applicants' independent Claims 1, 13, and 17. Accordingly, Applicants respectfully request the withdrawal of the rejection asserted against Applicants' independent Claims 1, 13, and 17 under 35 U.S.C. § 103(a) as unpatentable over the Basol reference in view of the Hsu reference.

Applicants' Claims 3-11, 14-16, and 18-21 are believed to properly depend, either directly or indirectly, from Applicants' independent Claims 1, 13, and 17. Therefore, Applicants also respectfully request the withdrawal of the rejection asserted against Claims 3-11, 14-16, and 18-21 under 35 U.S.C. § 103(a) as unpatentable over the Basol reference in view of the Hsu reference.

III. Conclusion

In view of Applicants' forgoing amendments and remarks, it is respectfully submitted that the rejections set-forth in the final Office Action mailed January 29, 2008, have been overcome. Accordingly, Applicants respectfully submit that the Application is now in condition for allowance, and such allowance is earnestly requested. Should the Examiner have any questions or wish to further discuss this application, Applicants request that the Examiner contact the Applicants' attorneys at (480) 385-5060. If for some reason Applicants have not requested a sufficient extension and/or has not paid a sufficient fee for this Response and/or for the extension necessary to prevent abandonment on this application, please consider this as a request for an extension for the required time period and/or authorization to charge Deposit Account No. 50-2091 for any fee which may be due.

Respectfully submitted,
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